RECLAMATION

era

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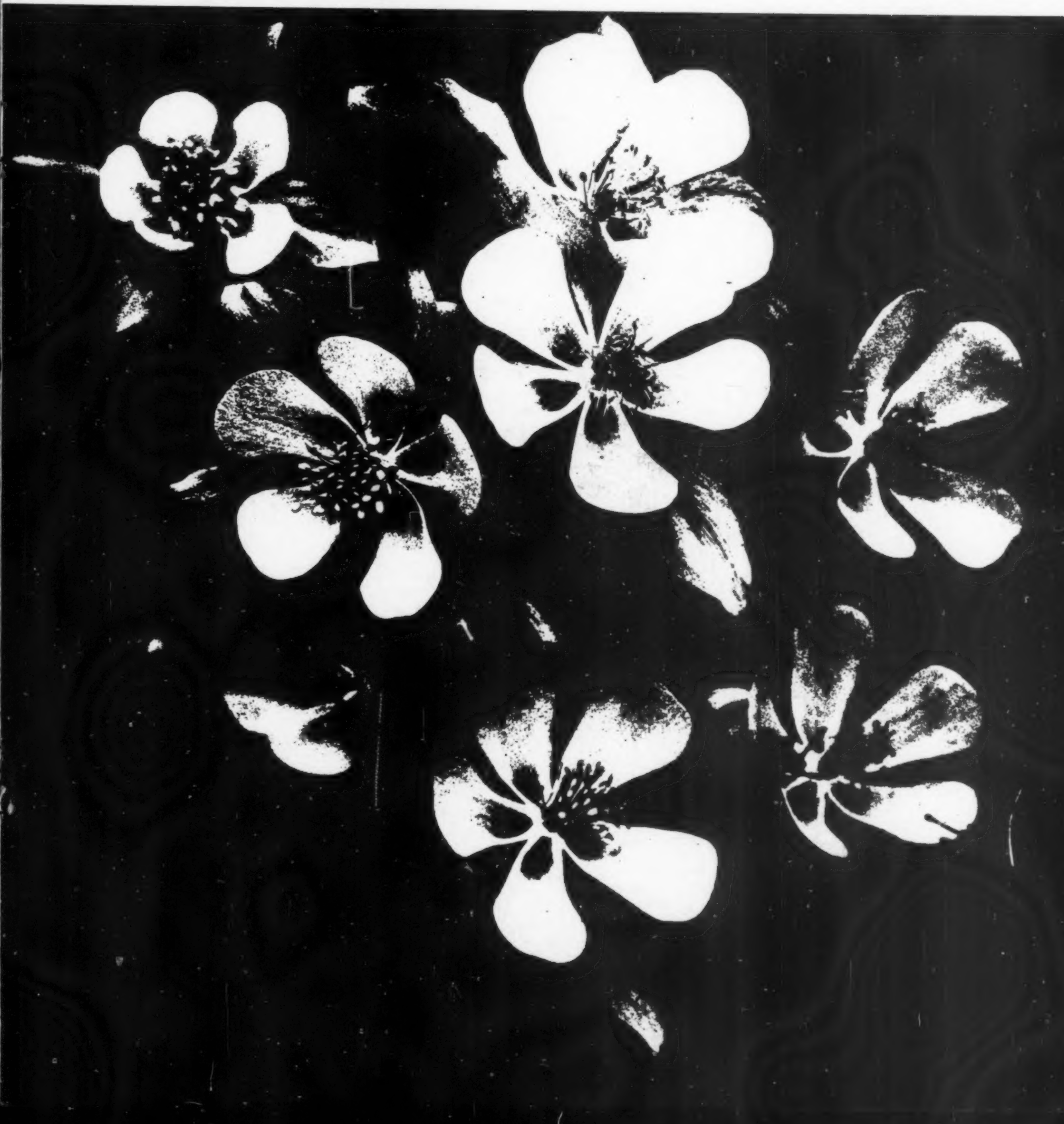
Spring 1974



Spring 1974 Vol. 60, No. 2

RECLAMATION era

Kathleen Wood Loveless, Editor

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United States Department of the Interior
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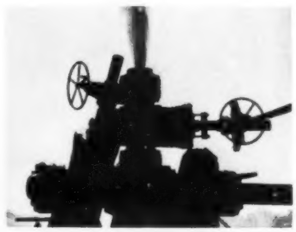
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How Water Brings the Desert to Life

By DR. SIDNEY SHAPIRO, Retired Marine Biologist, International Division, Fish and Wildlife Service, and

HARRIET E. SHAPIRO, Photographer and Botanist

Water can be both constructive and destructive to man and the environment. We see this everywhere in the world, but nowhere are the effects of water more evident than in the Southwest deserts and mountains of the United States.

In this article we shall concentrate on the Phoenix, Ariz., Salt River Valley complex and the Verde Valley to the north—and what makes a lush paradise in the desert.

Phoenix

The largest city in the vast Colorado River Basin is Phoenix, and its growth is vitally associated with irrigation and power development. Both have made the city and its surroundings not only a manufacturing and trading center, but also a rich agricultural and tourist area. Water—the most essential of about 45 nutrients in the human diet—is also the primary key to the area's existence and growth.

At an elevation of about 1,080 feet, Phoenix is located in the Salt River Valley, which is mainly a plateau surrounded by high mountain ranges. In 1910, the city had a population of only 11,100 but by 1972 this had expanded to 603,000, and over 1 million people if the nearby suburbs are included.

With a still growing population, the area has become a winter resort. The city and suburbs are dotted with extravagantly designed motels. Greenery now abounds almost everywhere in the city and the surrounding irrigated farmlands. Elsewhere in the Salt River Valley, arid desert prevails. One may see many cacti and extensive patches of sagebrush, the two-needled piñon pine (*Pinus edulis*), the Utah juniper (*Juniperus osteosperma*), and other typical desert vegetation. Surprisingly, there are many wildflowers, even in the most arid parts of the desert. Luxuriant Phoenix and its suburbs blend abruptly into the surrounding desert.

As one walks or drives through Phoenix and the surrounding country, the contrasts are remarkable. Many homes have swimming pools and plant life—cacti, cultivated flowers, and wildflowers.

Phoenix and the almost level land of the surrounding Salt River Valley are interrupted by rock formations that have withstood the erosive effects of water throughout the centuries. Diversion canals from the Salt River are everywhere. The city and suburbs sprawl over many square miles; only a few tall buildings are located in downtown Phoenix and in some of the newly built outlying sections.

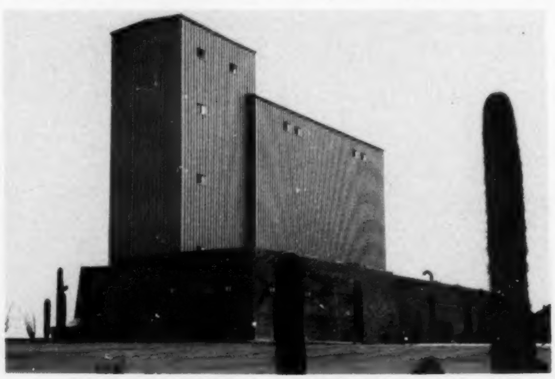
No Measurable Precipitation

When we reached Phoenix on April 27, 1972, the area had had no measurable precipitation for well over 100 days. What rain had fallen evaporated before reaching the ground. Upon our return to Maryland late in May, we heard a report that a flash storm, after 150 arid days, had caused severe damage, especially to Paradise Valley, a new suburb northeast of Phoenix.

You cannot have it both ways. To bloom, the arid flat land needs water, but there is little provision for rapid runoff.

Another deluge occurred in early October 1972, when tropical storm Jeanne dumped bucketsfull of rain on Arizona. Several areas in north Phoenix had to be evacuated when a canal overflowed because of heavy runoff. The Salt River project reported that its Arizona Diversion Canal, which flows through north Phoenix, spilled over its banks at several points. The National Weather Service said that during the 4-day storm 1.93 inches of rain fell. Normal rainfall for October is 0.46 inches.

Phoenix has many points of interests for the tourist. Papago Park, one arid unwatered place in east Phoenix, remains as the desert has been throughout eons of time. To the southeast of Phoenix is the suburb of Tempe, the home of ultra-modern Arizona State University and much commercial development—all based on water as the principal means of development. Camelback Mountain (northeast Phoenix), in unadulterated desert, has at its base luxurious homes and estates, all the result of an adequate supply of water.



The Papago Park Water Treatment Plant which supplies water to Tempe, Ariz. has been designed to blend well with the surrounding.

Each spring, these giant Saguaro cacti bloom into white waxy flowers that have become Arizona's state flower.

Desert Botanical Garden

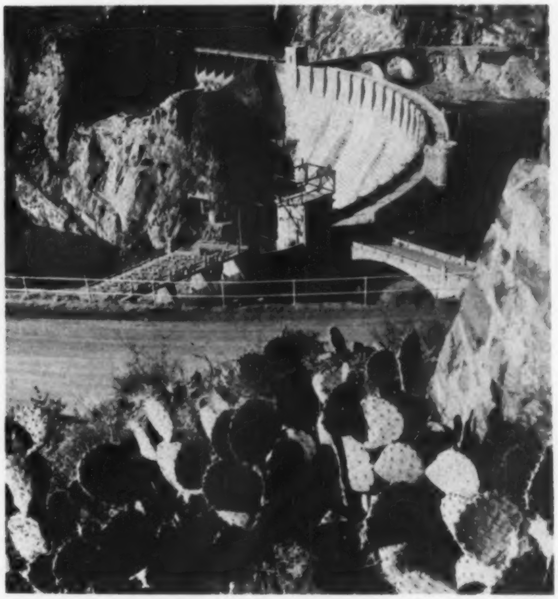
Another place to visit is the Desert Botanical Garden of Arizona, which has the largest collection of cacti in the world. The garden has thousands of species of plants from the world's deserts, although only 10 percent of the plants are from Arizona.

Flowing west through the south part of Phoenix is the Salt River, which originates in the highlands and mountains of east-central Arizona. Joining the Salt River east of Phoenix is the southward flowing Verde River, originating in the mountainous areas south and west of Flagstaff. More of the Verde later. West of Phoenix, the Salt River flows into the Gila River, which in turn flows into the Colorado River at Yuma, Ariz.

Reclamation Act of 1902

The Colorado River and its tributaries were surveyed during the late 19th century for irrigation and many plans were proposed. The Reclamation Act of 1902 established the Reclamation Service (now the Bureau of Reclamation) in the U.S. Department of the Interior. The act stipulated that the proceeds from the sale of public lands in the West should be applied to Federal reclamation projects.

Today, the public is aware of much-visited Colorado River power and irrigation projects, such as Hoover Dam, Glen Canyon Dam (which created Lake Powell, with its fabulous boating and recreational facilities), and dams in the Pacific Northwest and elsewhere.



Cactus in the foreground, Roosevelt Dam in the background illustrate that reclamation of arid land is possible.

Salt River Valley Project

Little known is that the first Federal multipurpose reclamation project was the Salt River Valley project, begun in 1903. The original plan provided for the construction of Theodore Roosevelt Dam and appurtenant structures on the Salt River. Roosevelt Dam is on the eastern side of the Mazatzal Mountains about 50 miles east of Phoenix.

In 1903, the estimate for the Salt River project was $2,800,000. By 1923, the cost had risen to $10,548,000. The original estimate was confined to the construction of Theodore Roosevelt Dam and associated features.

But the need for power was growing, so the Reclamation Service constructed power facilities at downstream Granite Reef Dam, the North and South Side canal systems, construction and maintenance roads, pumping stations, and provided a telephone system for regulating and monitoring the output of water.

The Reclamation Act of 1902 made no provision for hydroelectric generation and the sale of power, although this potential was recognized. Nevertheless, small amounts of power were generated at the Roosevelt Dam site for construction needs—drilling, mixing mortar, crushing rock, and so on.

A temporary hydroelectric powerplant of 950 kilowatts was built to furnish construction power. Built in 1906 in a cave of the Salt River Canyon wall, the Theodore Roosevelt powerplant was supplied water by a 19-mile canal. When the powerplant was transferred to the Salt River Valley Water Users Association in 1917, it had an installed generating capacity of 9,400 kilowatts.

Later, 19,290-kilowatt, 25-cycle generators were built. In 1971 these were replaced with new 36,000-kilowatt, 60-cycle generators.

Other Powerplants Assist

The demand for electric power for Phoenix and the Salt River project increased through the years, necessitating other sources of power. Power generated at additional Salt River project powerplants, Reclamation's Glen Canyon Powerplant and the Parker-Davis

The Fishhook Barrel Cactus blossoms are among the most beautiful in the desert.

Powerplants on the Colorado River and at powerplants of the Arizona Public Service Co., now more than meet the needs.

The generators of the Glen Canyon Powerplant have a combined capacity of 950,000 kilowatts. This is enough electricity for a ctiy of a million people. The massive transformers on the transmission structures near the dam feed electricity to five States. A good share of this electricity goes to Pinnacle Peak overlooking northeastern Phoenix.

The portion of the Salt River that is called the Salt River Canyon is about 40 miles due east of Roosevelt Dam. Although the canyon is not among the deepest in the world, it is truly an impressive sight. As we approached the canyon on its south side at a height of several thousand feet, we could see the river twisting and turning far below us, and at the same time obtain a panoramic view of the mountainous countryside.

The predominant vegetation about us belonged to what botanists have termed the juniper-piñon pine flora zone, which is typical of arid and semi-arid lands. Most of the water feeding the Salt River at the canyon comes from high mountains to the north and east. One of the peaks in the White Mountains of east-central Arizona is Baldy Peak with an elevation of 11,590 feet.

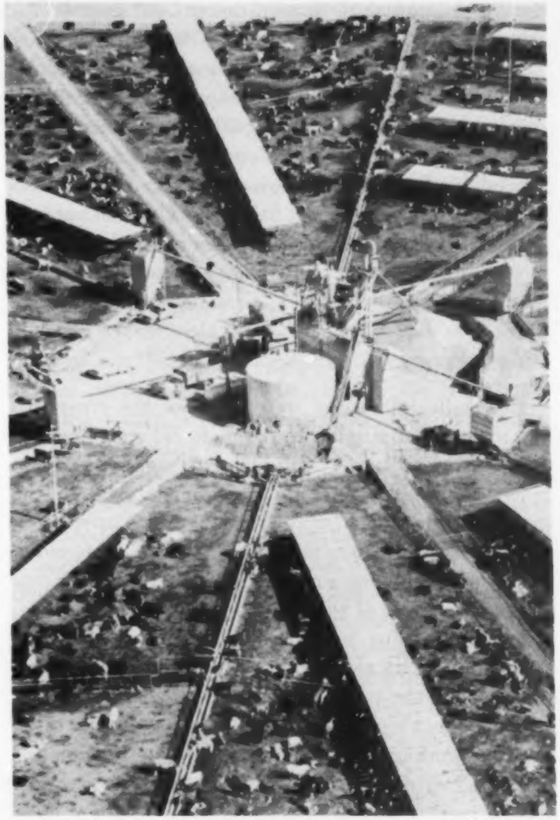
Even though we were at the Salt River Canyon during a severe drought, cacti and wildflowers—many in bloom—were seen in most places along the canyon walls. How does this blooming come about? Cacti have adapted to a water-storage system that tides them over even during severe dry spells.

But how about the blooming of wildflowers high on the canyon wall, though not in the profusion that they would be were there any measurable precipitation? Water comes from underground springs or the underground water table through to the surface by an action known as capillarity. We saw this blooming in even more arid desert areas elsewhere throughout Arizona.

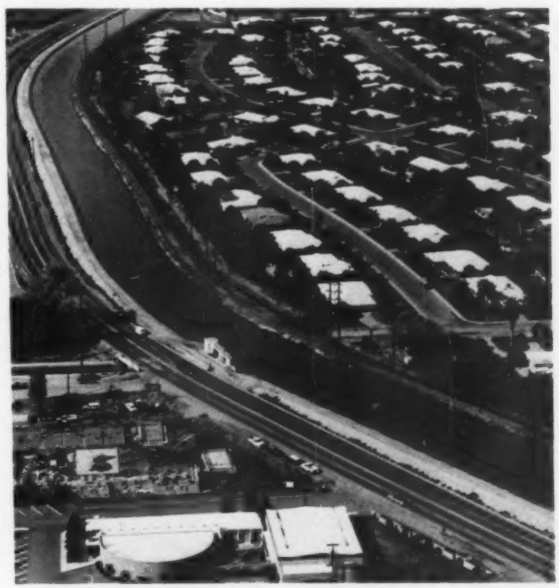
Recycling Project

There is an ever-increasing demand for electricity, and Salt River Reclamation people are constructing a novel pumped storage recycling project. On the north wall, a huge pipe can be seen extending up from the river to a complex hundreds of feet on the canyon rim. Water will be pumped to the rim at night and, during the day, it will spill over through turbines onto a concrete apron to create hydroelectric power.

We circled northern Arizona—with memorable sights of the Petrified Forest, Painted Desert, the Grand Canyon, the Colorado River, and Glen Canyon Dam. As we drove south through the Navajo Reservation toward Flagstaff, we went through mile after mile of



This is one of many commercial feedlots in the Salt River project area.



An aerial view looking west over the Arizona Canal at Scottsdale, Ariz.

the driest, most arid, flattest, desert land that we had yet seen.

Particularly impressive in many places were patches of wildflowers set against a background of sagebrush, piñon pines, junipers, and cacti. As Easterners, accustomed to associating the blossoming of wildflowers with rainfall, we were constantly amazed. We have already explained this flowering at Salt River Canyon, but here with no water and with dry washes everywhere it was more impressive, for not an iota of water could be seen anywhere.

Piñon Pine and Juniper

Especially interesting were some of the trees that had managed to survive and grow to old age. Through adapting to prolonged periods of drought, the piñon pine and juniper, already mentioned, exist in the desert and semi-arid lands. At the Grand Canyon and on our southern return to Phoenix, we saw many piñon pines, often growing out of seemingly bare rock and on desolate parts of the Navajo Reservation.

The piñon pine is a low-growing nut pine found in North America and Mexico. Most pines live in moist climates but the piñon pine can flourish in drier climates. It has a long line of pores in its leaves, and these pores are sunk in deep pits thus decreasing the amount of water lost through transpiration. The needles are also covered with a waterproof coating to keep moisture in.

The roots of this pine are often covered with a fungus that helps extract moisture from the soil. The coarse roots of the pine cannot do this, but the fine roots of the fungus can. This is a symbiotic beneficial relationship, for in return the pine supplies food for the fungus in the form of sugar synthesized in the green leaves of the tree.

The junipers are among the oldest trees on the continent. Some are over 2,000 years old. They are cone-bearing trees distantly related to the pines. The juniper can survive on little water for its leaves have been reduced to scales which closely clothe the smaller branches. The heavy shaggy bark also acts as insulation to prevent loss of water from the living tissues of the trunk. Old junipers look in poor health because their upper branches appear dead, but the trees nevertheless survive in almost impossibly arid country.

The Salt River project has made alfalfa harvesting possible near Phoenix, Ariz. There are approximately 37,000 acres planted in the project area with a total value of over $5 million.

Irrigation water used in the Salt River Valley in 1970 totaled over 1.25 million acre-feet, producing crops valued at $50 million.

Leaving Flagstaff, we continued south by way of Oak Creek Canyon, and came upon another facet of the expanding central Arizona irrigation complex. Oak Creek originates in the mountains southwest of Flagstaff, and wends its way southward through gorges surrounded by brilliantly hued rock formations. It is a camper's and tourist's delight and fishermen can catch an amazing variety of sport fish. Oak Creek is one of the many streams that feed into the Verde River, which flows into the Salt River. As we went farther south we returned to the arid desert. About 100 miles north of Phoenix, we decided to visit Montezuma Well and the Verde Valley.

Other Water Sources

Water in desert land can come from sources other than irrigation projects. Underground rivers and springs cross some parts of the desert. Montezuma Well is near the northeast corner of Verde Valley. The well is a small but important factor in the agricultural prosperity of the Verde Valley.

Montezuma Well is a natural limestone sink, oval in shape, and with a maximum depth of 55 feet. It measures 470 feet across, and the surface of the water is 70 feet below the rim of the well's wall.

Water enters the well from underground springs and leaves through the south wall at a daily discharge rate of 1.5 million gallons. This water flows into Beaver Creek, which flows southeastward into the Verde River. Many centuries ago this constant source of water was the center of a thriving Indian community that used the well's discharge to irrigate the bottomlands of nearby Beaver Creek.

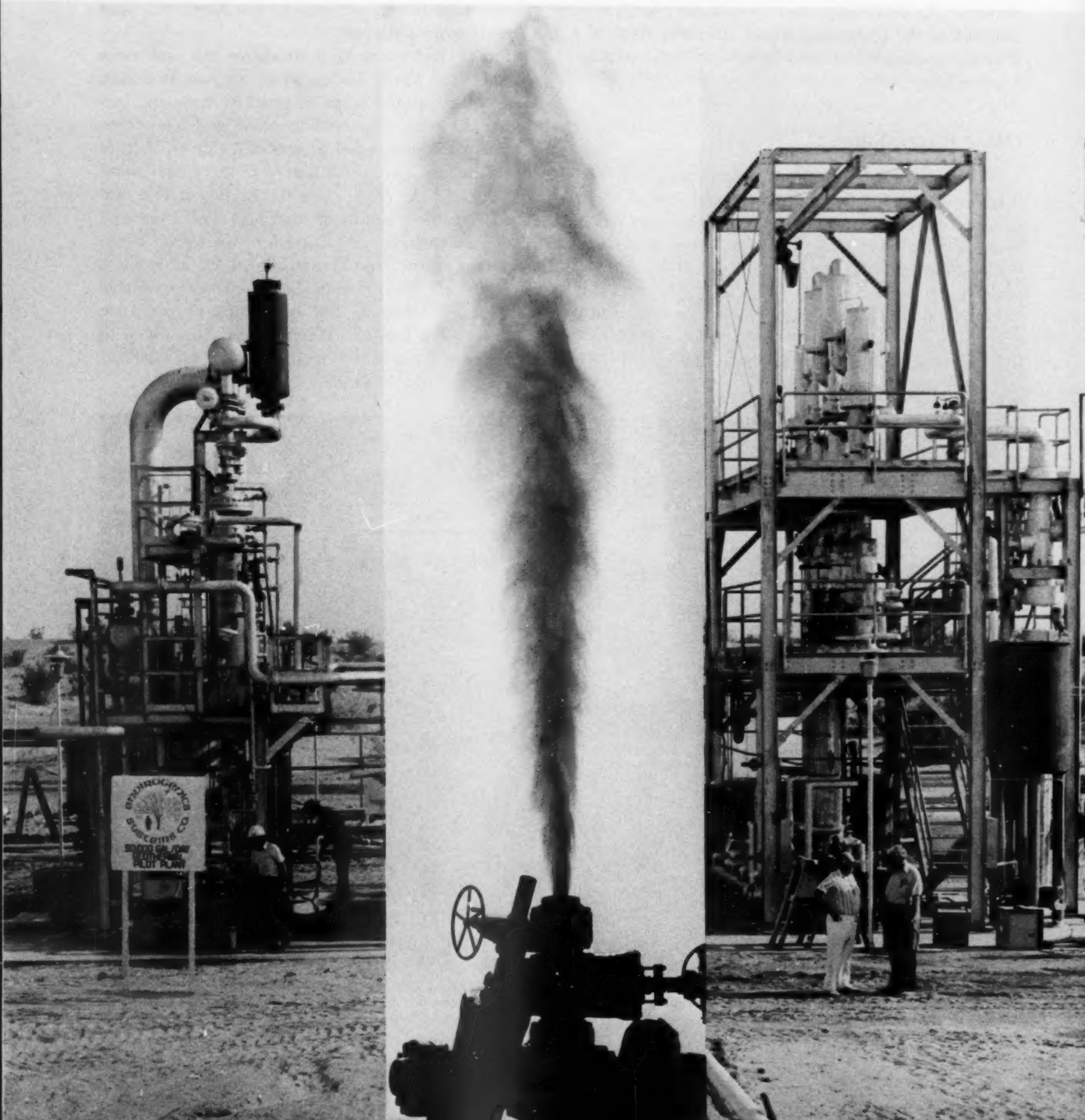
Today, one may see some of the ruined homes of these Pueblo people—among our first Americans—just below the rim of the well.

From Montezuma Well we drove east and south through the Verde Valley. Here we saw acre after acre of agricultural crops irrigated by wells and surrounded by the all-pervading desert and mountains.

There are many other aspects of the desert that we could discuss—geological history to show how water has affected the desert since the Earth's earliest pre-Cambrian time; uplifts of land and how water and wind erosion have carried much of the topsoil away; mineral deposits; and erosion. But, each subject is a story of itself. There is no doubt, to make water suitable for human, industrial, and agricultural purposes, we all must work together. Water means many things to many people, but to us if used wisely it is the lifeblood of progress and civilization.

The University of Arizona at Tempe. The expanding population in central Arizona has created the need for additional municipal and industrial water supplies.

Reclamation's Geothermal Story



By SUSUMU SUEMOTO, Supervisory Mechanical Engineer, Bureau of Reclamation Geothermal Test Site, Imperial Valley, Calif., and

WAYNE FERNELIUS, Chief, Engineering Branch, Lower Colorado Region, Bureau of Reclamation, Boulder City, Nev.

While nations of the world focus on scientific teams exploring the sea and outer spaces, one equally dedicated team of geologists and engineers from the Bureau of Reclamation is exploring the earth's inner spaces.

The team's objective is to tap the Earth's millions of acre-feet of geothermal water and utilize its energy to convert salty water to fresh. And they are successfully doing just that in the outlying desert just east of the small community of Holtville in Imperial Valley, Calif.

The advantage of geothermal desalting as envisoned by this group of engineers is that the application of heat, so essential for the distillation of sea water, is not required from external sources in geothermal developments. The Earth yields heat naturally in the form of hot fluids which it releases with a force that man seeks to master.

Untapped Resource

Geothermal deposits are among the Nation's untapped resources. They could provide electrical energy, fresh water, and possibly mineral byproducts without the associated air pollution so prevalent with other methods of energy, water, and mineral production.[1] The existing use of geothermal energy is limited because of technological problems and the inaccessibility of geothermal resources. With the impending shortage of electrical energy, however, new developments of geothermal resources are expected to increase rapidly in the near future.

The Bureau of Reclamation is exploring the geothermal resources in Imperial Valley, Calif. It is searching for an additional water supply for the Colorado River, the most highly regulated and intensely utilized river in the United States. Water shortages in the foreseeable future are quite probable unless new water supplies are found.

The Bureau's research and development program is investigating the feasibility of desalting geothermal fluids and delivering the fresh water to the Colorado River system to help meet the future needs of the arid Southwest. The addition of quality water would also counteract the increasing salinity of the river, which is rapidly becoming a serious problem.

Significant progress to date includes the drilling of one 8,000-foot exploratory well, Mesa 6–1, in August 1972, and a second well, Mesa 6–2, to a depth of 6,000 feet in August 1973. Two test desalting units have been installed and are operating at the Mesa 6–1 well site. The results are encouraging (see fig. 1).

At the test site, mechanical engineer Susumu Suemoto and a small Reclamation crew are using their talents to accomplish Reclamation's goal to desalt geothermal fluids and to transport fresh water to needy areas.

How The Program Began

Reclamation began its geothermal program by contracting with the University of California at Riverside for preliminary geothermal investigations in Imperial Valley. The university conducted an investigation of gravity, resistance, heat flow, and geology. The study provided data required to locate test facilities in a promising area. The university is presently conducting microseismic surveys under contract with the Bureau of Reclamation.

The Geological Survey is conducting groundwater surveys and has established a seismic monitoring network in Imperial Valley. The Survey has outlined the groundwater basin, making a preliminary determination of recoverable groundwater in storage. Recoverable geothermal fluids in storage are estimated to be over 1 billion acre-feet.

[1] It should be noted, however, that sometimes there is a strong odor accompanying geothermal fluids, caused by hydrogen sulfide gas.

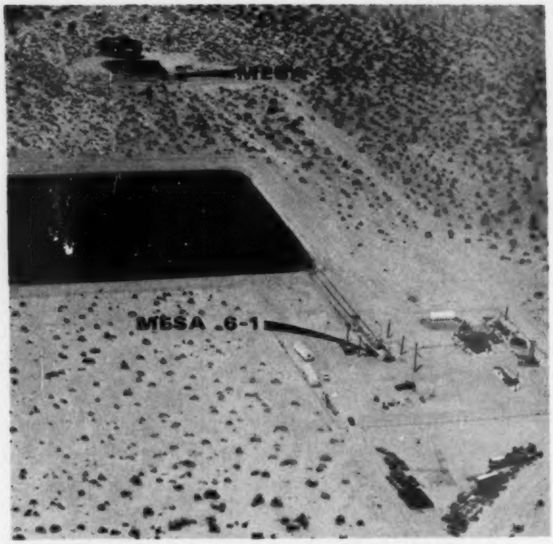


Figure 1. Aerial view of test well sites Mesa 6–1 and Mesa 6–2.

In 1971, Reclamation became actively involved in geothermal investigations by drilling a number of temperature-measuring holes (see fig. 2). A more intense research program was initiated when the Bureau drilled the deep test well, Mesa 6–1, on the promising Mesa anomaly. The well, about 10 miles east of Holtville, Calif., required nearly 2 months of drilling and testing to complete the operation.

A 9⅝-inch production casing was installed from the surface to a depth of about 7,300 feet. A 7-inch liner was hung in the bottom of the production casing to a depth of about 8,000 feet. The liner was slotted at selected intervals for a length of 426 feet with slots one-fourth inch in width (see fig. 3).

The high temperature and pressure from under the Earth's surface force the geothermal liquid into the liner and up through the well's production casing. As the liquid rises, the pressure decreases and part of the liquid flashes into steam. It emerges from the well as a mixture of steam and liquid.

Figure 2. Space view of Imperial Valley, Calif.

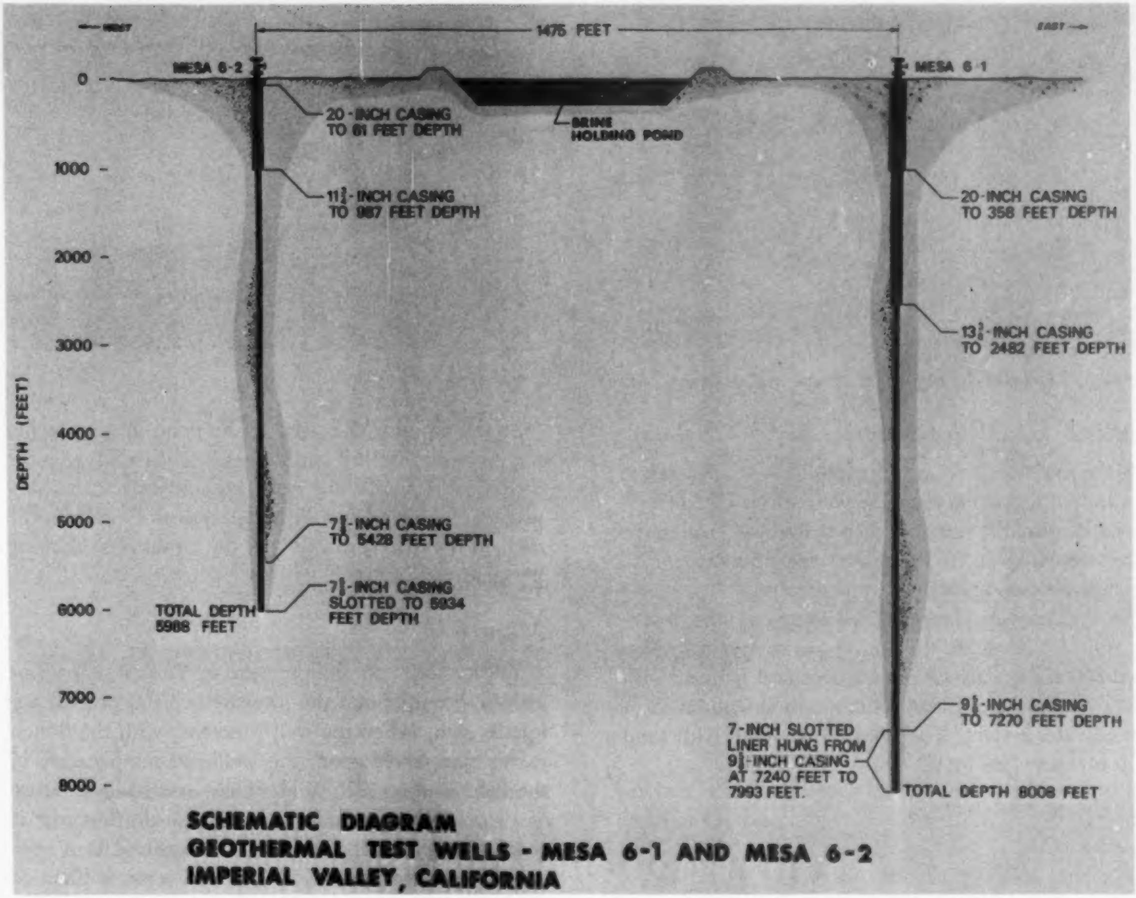


Figure 3.

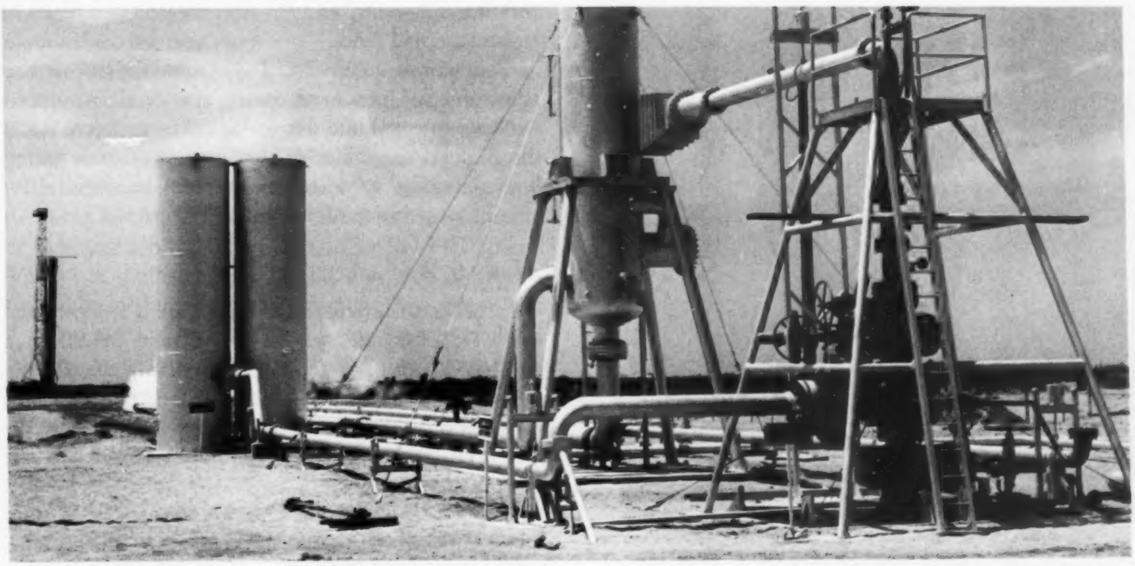


Figure 4. Mesa 6–1 test site showing (right to left) wellhead, separator, and vertical silencer. The drilling of Mesa 6–2 proceeds in the left background.

Figure 5. The brine-holding pond is lined with polyvinyl chloride.

Cyclone Steam Separator

Since the desalting units operate on separated steam and liquid, a cyclone steam separator was installed. It is located near the well as shown in figure 4. Automatic valves were installed in the connecting piping to control pressure and flow rates from the separator.

Some of the liquid, not needed to operate the desalting units, is bypassed to the evaporation pond. The pond has a capacity of 38 acre-feet and is lined with plastic material to prevent contamination with the local groundwater system. The plastic is covered with sand for protection (see fig. 5).

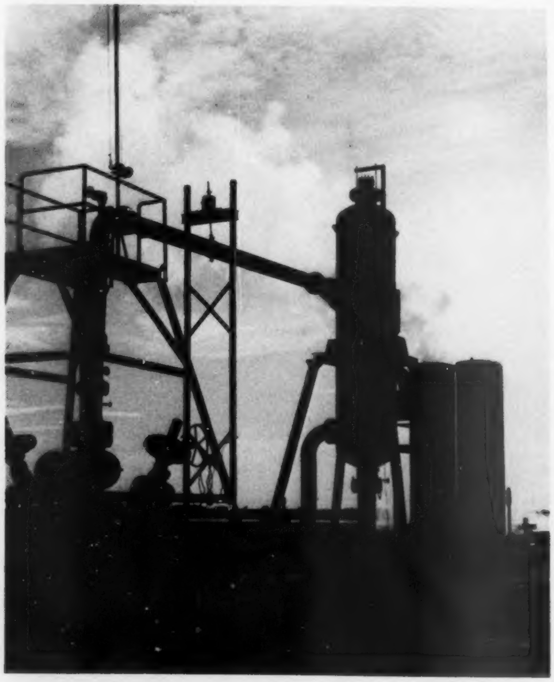


Figure 6. Silhouetted against the sky are the wellhead valving, steam separator, and vertical silencer.

As the liquid is delivered to the pond, it approaches atmospheric pressure and flashes into steam. A silencer is needed to muffle the noise created by the flashing process. A weir box was installed downstream from the silencer to measure the flow of the liquid after flashing has occurred (see fig. 6).

Mesa 6–1

The bottom hole temperature of Mesa 6–1 is about 400° Fahrenheit and the pressure is 3,100 pounds per square inch. When the well is flowing with the 8-inch valves completely open, the wellhead temperature of the fluid is about 225° Fahrenheit and has a pressure of 10 pounds per square inch. The liquid flow rate is about 200 gallons per minute as measured in a weir box. The quality is about 20,000 parts per million of total desolved solids (TDS). Temperature, pressure, quality, and flow tests are continuing at this well to determine the well's behavior and the characteristics of the geothermal fluids.

To maintain continuity of operation, the large quantities of brine produced during the desalting process will be reinjected into the geological formations. While the disposal capability of the lined pond will permit limited testing, an injection well will be essential for continual operation of the desalting units.

Mesa 6–2

In order to provide this capability, a second deep test well, designated as Mesa 6–2, was drilled to a depth of about 6,000 feet on the anomaly about 1,475 feet west of Mesa 6–1, and a 7⅝-inch production casing was placed from the surface to a depth of 5,934 feet. The lower 500 feet of the production casing was perforated.

Recent testing of Mesa 6–2 indicated a bottom hole temperature of 370° Fahrenheit. Wellhead temperatures of 290° Fahrenheit at 44 pounds per square

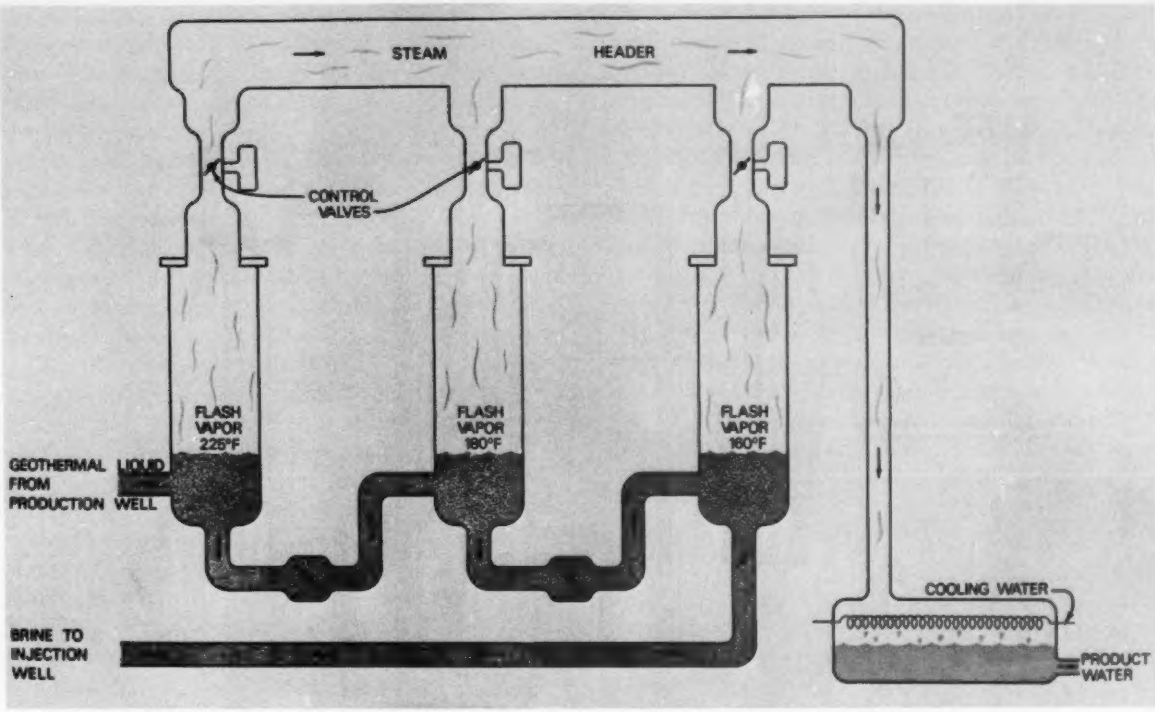


Figure 7.

inch have been recorded with the well flowing through a 3-inch orifice plate. Maximum liquid flow rates and temperatures have been calculated to be higher than the flow rates of Mesa 6–1 under similar conditions.

The quality of the liquid is about 4,000 parts per million (TDS) after flashing has occurred. Because of its substantially better production characteristics, it is planned to use this well for production and Mesa 6–1 for reinjection. Reinjection will probably be necessary to prevent subsidence, which could otherwise become a serious problem for the highly developed irrigation system of the valley.

In cooperation with the Office of Saline Water, two desalting test units have been installed at the Bureau of Reclamation's geothermal test facility in Imperial Valley: A multistage flash distillation unit and a vertical tube evaporator distillation unit (see figs. 7 and 8). The units, shown in figure 9, are used to evaluate various procedures for testing different quantities of fluid. They were designed to use hot fluids from geothermal production wells. Each unit has a capacity of 20,000 to 50,000 gallons per day, depending upon operating conditions.

Distillation methods of desalting are particularly appropriate since the geothermal fluids are already heated. Using the oldest known principle of purifying water—distillation, the hot fluid is allowed to flash or boil, then the vapor or steam is condensed to produce pure water.

To date, several thousand gallons of quality water (less than 30 parts per million) have been produced in the multistage flash distillation unit. The vertical tube evaporator has been operated for several hours, producing some desalted water. At present, the steam production is vented to the atmosphere. At a later development stage, steam will be used to increase the efficiency of desalting and could be used to generate electrical power.

Multistage Flash Distillation Unit

In the multistage flash distillation test unit, the geothermal liquid is flashed in three successive flash vessels of decreasing temperature and pressure. The steam or vapor from each stage is cooled in a heat exchanger by cooling water. The cooled desalted water is then pumped to a storage tank.

Vertical Tube Evaporation Unit

Installation of the vertical tube evaporator test unit was completed in July 1973. This test unit is now undergoing shakedown operations to determine equipment and design functional characteristics. Like the multistage flash, this process operates on the principle that water boils at progressively lower temperatures

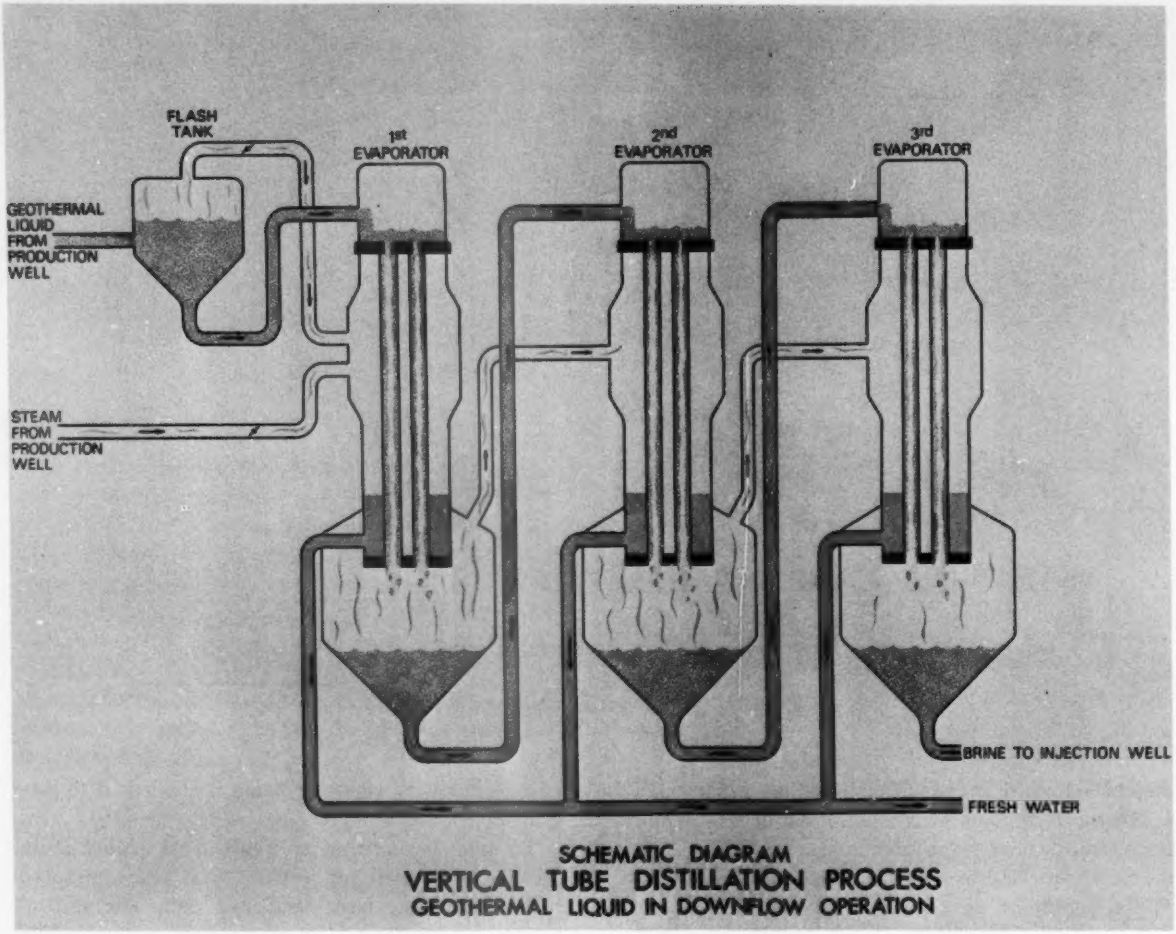


Figure 8.

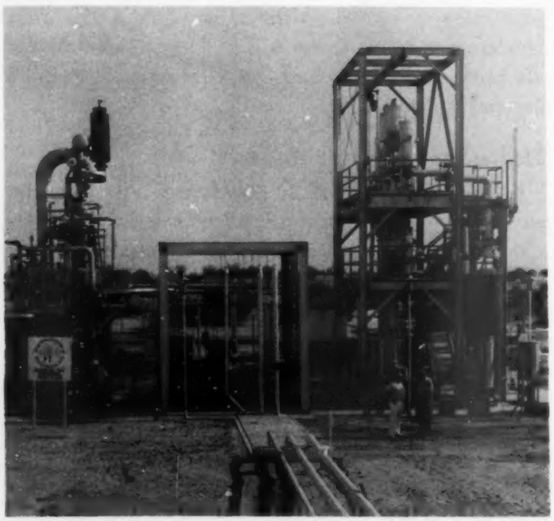


Figure 9. Shown here are the multistage flash distillation desalting plant and the vertical tube evaporator distillation desalting plant.

when delivered to vessels having progressively lower pressures.

The hot geothermal liquid (after separation from the steam) flows through a bundle of vertical tubes located inside a large chamber. As the liquid flows through the tubes, it receives additional heat from the steam surrounding the tubes. This heat exchange process converts some of the liquid into steam, and at the same time condenses some of the steam into fresh water.

During the initial operation of the unit, the geothermal liquid will flow up through the tubes. As the experiments progress, a downflow will be tested to determine the optimum operation.

To obtain high efficiency, the process is repeated in several evaporator chambers called evaporator effects. These effects are arranged in series. The steam for the first evaporator is supplied by steam flashed from the geothermal liquid in a flashing vessel at the desalting unit or from the well separator, depending on the

test to be run. The water condensed from that steam is collected and delivered to the product water storage tank. Steam generated inside the tubes of the first effect flows to the second effect where it surrounds the second bundle of tubes.

Brine, not vaporized in the first effect, enters at the top of the second effect and flows down through the second tube bundle. The steam which surrounds the tubes adds heat to the brine as it flows down, converting some of the water inside the tubes into steam, and condensing some of the steam outside of the tubes into fresh water.

This process is repeated through several effects. The temperature of the saline water drops as it progresses through the series of effects. The pressure in each effect is also progressively reduced to permit vaporization to occur at lower temperatures. The brine which collects at the bottom of the last effect is discharged and will be reinjected into underground aquifers for disposal.

This "first-ever" project is planned to determine the problems of desalting geothermal fluids. Although much work has been done in desalting sea water, little has been done with geothermal water. Because of the unique characteristics of geothermal water, significant research must be accomplished to determine exactly how geothermal fluids react to desalting equipment. The corrosion and scaling tendencies on vessels and heat exchanger surfaces must be determined. Many problems with equipment, which in many cases cannot be anticipated, must be solved.

On July 31, 1973, Regional Director Edward A. Lundberg demonstrated to reporters and photographers of newspaper, radio, and TV the purity of the desalted geothermal water. Mr. Lundberg did this by drinking the "first cup" of desalted water from the multistage flash test unit.

Began in 1971

The geothermal desalting program actually began in 1971 when the Office of Saline Water initiated a series of tests on laboratory and pilot test units using synthetic geothermal fluids. A multistage flash test vehicle was constructed and operated by the Environgenics Co. of El Monte, Calif.

The vehicle was originally erected at the Office of Saline Water's facility at Wrightsville Beach, N.C. From these tests evolved the multistage flash unit and vertical tube evaporator now located at Reclamation's geothermal test facility in Imperial Valley, Calif. The vertical tube evaporator unit was designed by the Office of Saline Water and by Burns and Roe of Oradell, N.J., and was constructed and erected at the Imperial Valley test site by Aqua Chem, Inc. of Milwaukee, Wis.

With new technology learned from these first onsite test units, larger plants can be designed and built. The program is planned for two more desalting plants of increasing size. It is hoped that one day a prototype desalting plant of 2 to 5 million gallons per day or larger can be built to show that water can be obtained inexpensively. Ultimately, millions of acre-feet of desalted water could be delivered annually to the Colorado River at Imperial Dam, Lake Havasu above Parker Dam, or Lake Mead to dilute their waters.

Replacement Water

With the depletion of several million acre-feet of water from the groundwater basin, importation of replacement water for injection would be essential. Possible sources of replacement water would be the Salton Sea, which has a salinity problem that could be improved by providing an outlet, or the Pacific Ocean which could supply large quantities of water.

While the production of desalted water is the paramount goal of the program, possibilities for a multipurpose development will be evaluated. For example, it has been estimated that the geothermal steam could be used to produce up to eight times as much electrical power as the capacity of Hoover Dam's generators, a significant point in view of the power shortages in the Nation. Another possibility is the recovery of marketable mineral products from the waste brine. Such concurrent developments would provide the maximum benefits from the geothermal resources at minimum cost.

Being the first experimental program of geothermal desalting, the well site has visitors from all over the United States as well as many foreign lands, including Mexico, Canada, Japan, Afghanistan, India, New Zealand, Portugal, Italy, Turkey, and England. These nations have come to a tiny manmade oasis in the desert near Holtville, Calif., to learn about the U.S. geothermal desalting program.

THE HUNTL

What it was

Editor's note: The following article was written by the students of Huntley Project High School in conjunction with their social studies and English classes. Those taking part were:

Threshing the first crop of grain irrigated by the Huntley project, November 16, 1908.

LEY PROJECT

as and why it was.

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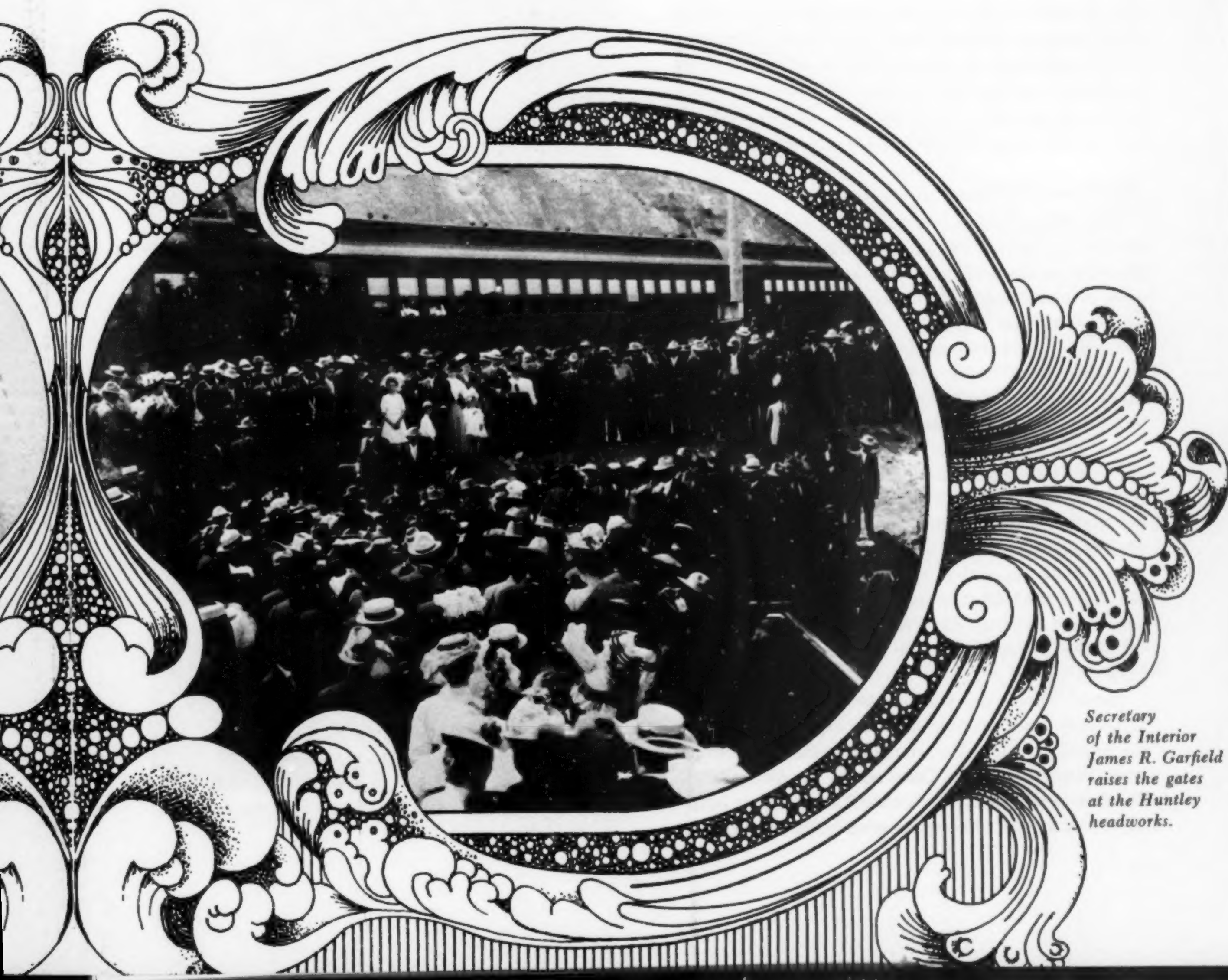
Susie Caster; Debbie Cleveland; Karen Kratochvil; Howard McCranie; Barbara Oblander; Holly Osmundson; Steve Sian; Dan Van Luchene; Mrs. C. F. Gruenert, supervising teacher; and Mr. Calvin McRae, principal



Secretary of the Interior James R. Garfield raises the gates at the Huntley headworks.

The Crow Indians roamed the land far and wide, until they ceded it, the Huntley project, to the United States in 1904.

In August of that year, the Reclamation Service began investigations to see if it had irrigation possibilities. The project was designated for development and the first detailed plans were drawn up early in 1905. When these plans were given to the board of engineers, the project was declared feasible and construction was authorized by the Secretary of the Interior, E. A. Hitchcock, on April 18, 1905. Actual construction of the project began 6 months later, and the first irrigation water was available for settlers in 1908.

The Huntley project was one of the first projects to be established under the Reclamation Act of 1902, which provided for the building of irrigation systems in the arid Western States.

The preliminary survey was for 30,000 acres. After 2 years, the system was completed and in 1907 the headgates were opened. The Secretary of the Interior was present for the opening ceremony, and a special train ran from Billings, Mont., to transport spectators.

The total cost of the project was estimated at $1 million, to be repaid in 10 years. By 1912 the whole project was nearly completed, with 530 families settled on 3,321 acres of irrigated land.

Early Explorers

The earliest record of the Huntley project area indicates it was first explored in 1805 by Laroque, a Frenchman from Canada. He was sent through the area to establish fur trading with the Indians for the Hudson Bay Co. of Canada.

Further exploration of the region was made in 1806 by Meriwether Lewis and Captain William Clark. Clark carved his name on a rock which was later named after the baby born to his Indian bride, Sakajawea.

In 1807, Manual Liza, of the American Fur Trading Co., and his partner, Colter, built Liza's Fort at the mouth of the Big Horn River to establish fur trade with the Indians. Undoubtedly, he or his men came into the Huntley project area.

Hayden's expedition (named after the surveyor, Hayden), 1855–56, was guided by Jim Bridger. This expedition came up the Yellowstone Valley and surveyed the area while enroute to Yellowstone National Park.

James Stuart, the younger brother of Montana's first Territorial Governor, made an expedition through the region in 1863. He went down the Yellowstone from Virginia City via Bozeman to Pompey's Pillar. He then turned south across the Crow Indian country, where several of his party were killed by the Crow and several others were wounded. This was one of the few instances in which whites were attacked by Crows. Stuart's reason for coming to the project area was his pursuit of gold.

Huge Ice Jam

The railroad originally was supposed to cross the Yellowstone River at Huntley, but because there was a huge ice jam in the river and subsequently floods in the spring of 1882, the company decided to continue on the south side of the river. The town of Huntley moved south of the river to be near the railroad.

After the Sioux and Cheyenne were forced back on their reservations, the white men were able to establish permanent settlements.

Just 73 days after being planted, the corn crop of 1908 seemed to please E. C. Sampson. Photo courtesy, Huntley Irrigation District.

A fine specimen from a sugarbeet field in 1906. Photo courtesy, Huntley Irrigation District.

Expeditions

There were several other expeditions through this area—mostly by buffalo hunters. The largest expedition was the Gore Expedition. However, none of the groups established permanent towns or posts because of Indian hostility. The Sioux and Cheyenne wanted to keep the Yellowstone Valley for their hunting grounds and as an access to the area where they stole horses from the Crows.

The owners of the Northern Pacific Railroad wanted to build a railroad to the Pacific coast, and they planned to come up the Yellowstone Valley to Bozeman, so they cut across the mountains to the coast.

Surveyors were working from both the west and the east. Those who came in from the east had to quit because of Indian hostility, so the Government ordered Maj. Eugene Baker, with 249 soldiers to accompany surveyor Hayden and his men down the Yellowstone River. When they came within 2 miles of Huntley, they decided to camp and rest before continuing down the valley. This was in August of 1873.

A local passenger train, "The Dinky," ran between the Huntley project and Billings, Mont. Photo courtesy, Huntley Irrigation District.

The first grain crop on the Huntley project was harvested at the A. Kinmouth farm. Photo courtesy, Huntley Irrigation District.

Black Moon

In the meantime, Black Moon with between 400 and 1,000 Cheyenne Indians, was coming up the valley to steal horses from the Crows. When he reached the vicinity of Pompey's Pillar, his scouts reported Baker's camp and his fine horses, so the Indians decided to attack the soldiers and steal their horses.

The attackers killed two men and got the cattle which they used for food, but they did not get the horses. Hayden decided it was too dangerous to continue, so they all returned to Bozeman.

Drawing in Billings

The project actually opened after a drawing was held in Billings, Mont., in July 1907. Secretary of the Interior James Rudolf Garfield presided. Those interested in claiming land on the project signed their names to a numbered slip of paper and deposited their "raffle tickets" in a large tank. Then a little girl was chosen to draw the numbers.

The stipulations were that the settlers could claim a 40-acre homestead. He who held the first number drawn, got the first choice of the 30,000 acres of land. The settler then had 2 weeks to select his land and make a claim. After his 2 weeks were up, settler No. 2 had 2 weeks to do the same. If a settler did not file in 2 weeks, he was not allowed another chance to file later.

Of course, the land had to be purchased. The settlers had to pay $4 to the Crow Indians, 60 cents for the use of irrigation water and a $160 down payment. Afterwards, payments were yearly.

In 1907 the project was mostly sagebrush and greasewood with a few homestead cabins or shacks dotting the country. The land was nearly without trees, except along the river. And there were a few Indian relics still around.

Huntley was the largest town in Montana in 1907; Pompey's Pillar was the next to spring up. The first schoolhouses were at Osborn, Huntley, Ballantine, Worden, Hillside, Anita, Pompey's Pillar, Porter, and Riverside.

Most Packed Guns

Mrs. C. O. Stout, one of two school teachers described Huntley, "Most of the men packed guns around with them. Chiefly young people came to file for land.

Herman Becker supplies his cows with commercial pellets and has them graze in irrigated pastures.

Each farmer had small amounts of livestock. Farmers raised oats and corn and just enough potatoes to get by on.

"Wildlife was abundant everywhere on the project. Hunters even found several wild turkey. Rabbits were so thick it was easy to kill one by throwing a rock in any direction. Wild horses roamed the valley, but buffalo were practically extinct."

Railroads Main Transportation

In the early days of the project, railroads were one of the main types of transportation. Each train had about 30 boxcars and 5 passenger cars. A local passenger train, called "The Dinky," ran between the project and Billings. It had three to five cars.

There was no bridge between Huntley and Billings. Before the bridge was built, residents had to cross the Yellowstone River by boat. The first bridge across the river near Huntley was finally built around 1907.

The only transportation for the children to high school was a truck kept in Huntley. At that time there were few automobiles.

The Town of Ballantine

Ballantine was established in 1907 and was named after a Burlington Railroad conductor. It is near the center of the Huntley Project Irrigation System.

The only school in Ballantine was scheduled to start in the fall of 1908, but the opening was delayed because the building was not completed. In the late fall, the two-room schoolhouse was occupied for the first time. Mrs. C. O. Stout taught the first through fourth grades and Mr. Hancock taught the fifth through eighth grades. The school was nicely finished, but had no supplies except blackboards and chalk. There were no books except an unabridged dictionary. But the people and children were pleased with what they had.

Ballantine contained a Congregational Church, built in 1912, 4 years after the first service. In 1908 the Reverend Joseph Pope and Robert Bryson held the first church service in an unfinished store.

Hymnals were given to the church by a lady whose husband was building a small saloon. And a tent was donated by the Missionary Society for the minister's housing. Later, pews and an organ were installed in the church. Ballantine was now a town with an honest-to-goodness church.

Ladies' Aid

Soon after the completion of the church, the Ladies' Aid was started. Its main purposes were to find entertainment for the community and to supply the needs of the church. As time passed, the Ladies' Aid helped furnish the church, provided supplies for the Sunday School class, and paid for the organ. The Ladies' first entertainment was an ice cream social, which proved to be quite successful.

Helpers had to drive to Huntley with a horse and team to get cream. They then made the ice cream in handcrank freezers. The money from this event went to the purchase of the organ, the first payment was $650.

Events such as the ice cream social were rare, and there was always a big turnout for every occasion. At a dinner given by the Ladies' Aid, 25 cents was charged for a meal of chicken, potatoes, cabbage salad, rolls, and jellies. It was a financial success.

Many farms in the Yellowstone River Valley receive irrigation water from the Huntley Main Canal.

George Baum shows George Brazer the kind of corn ears he likes to chop for silage.

The Town Grows

Main Street ran a block east of where it is now. The depot was a boxcar until a building was constructed in its place in 1909. The grandstands for the public park, where the first rodeos were held, sat where the Ballantine Hall (a dancehall) now stands. A bank and a hotel were built in 1911, but the hotel burned down in 1932. A cheese factory, used by the local dairymen, was erected in 1912. Later, in 1944, the Future Farmers of America boys converted the building into a cannery.

A newspaper, the Project Pioneer, was soon established. A doctor's and dentist's office, drugstore, hardware store, lumber yard, meat market, pool hall, grain elevator, blacksmith shop, and a telephone exchange were some of the businesses of this era. The pool hall, bank, and beer parlor were established in 1911.

George Brazer fills the pit silo with corn.

Herefords climb the chute to a truck for a short ride to Billings, Mont., and the auction ring. All the grain and ensilage used in feeding them are raised at an irrigated farm.

First Rodeo Town

Ballantine was considered the first rodeo town on the project. An exciting rodeo was held every July 4th. People came from all over the project to watch or to participate. The rodeo drew tremendously large crowds. Unfortunately the grandstands collapsed at one event, resulting in many injuries.

Other places of entertainment in Ballantine were the two dancehalls. One of them was owned by John Webb, the other was managed by Bill Watson. One hall is presently the Ballantine Hall.

Because of the Depression, many of the original businesses had to close down, never to be replaced or reopened. In addition, as transportation facilities improved, many of the early settlers decided to move farther west. As a result of these two factors, the town changed from a commercial center into a residential community.

Pompey's Pillar

Pompey's Pillar is located on the eastern end of the Huntley project. It is approximately 12 miles east of Worden, and 20 miles west of Custer.

The town received its name from the historical landmark, Pompey's Tower—later called Pompey's Pillar. The first settlement was a section house built by the Northern Pacific Railroad 1 mile south of the rock. This building later burned to the ground.

The second settlement was built on the present site in 1905. The buildings were three boxcars occupied by railroad employees. In 1908, a general store, a saloon, and a two-room schoolhouse were constructed. There was also a printing office which published the town newspaper, *The Pompey's Pillar Rock.*

In the following years many other businesses and buildings were added. In 1910 the Congressional Church was built and in 1920 the Catholic Church was erected, after several years of holding services in homes and various other meeting places. The businesses added were two general stores, two blacksmith shops, barber shop, garage, livery stable, grain elevator, hotel, pool hall, saloon, dray station, butcher shop, and a restaurant. Mail was delivered by handcar, before the U.S. Post Office was installed.

Pompey's Pillar was destroyed three different times. In 1916, a cloudburst and heavy hailstorm caused considerable property damage. In 1920 a fire swept through the town. It was partially rebuilt, but after a second disastrous fire in 1933, everything was left as it was. Today the town consists of a store, post office, two bars, and two garages.

Worden

The town of Worden first was on the south side of the railroad tracks; but the town caught on fire and later was moved to its present location near the center of the Huntley project.

Worden was one of the last towns to be established and is now the largest. The next few years may well see it become the shopping center for large suburban growth developing around Billings.

In earlier years, Worden was pronounced "Werden." It was named after Gov. Joseph H. Dixon's wife, Werden.

Worden's first elementary school was built in 1908, and the first high school in 1912. The junior high was built in 1939. After consolidation of schools, a new grade school was built in 1956. Today, all pupils are transported to Worden and the outlying schools have been discontinued.

The Worden Methodist Church was organized April 23, 1911, and the church building was constructed in 1914. There were two other churches, the Bethlehem Congregational and the Church of the Nazarene.

Worden established a newspaper, *The Yellowstone,* after the consolidation of the *Huntley Journal* and the *Pompey's Pillar Rock.*

Although many Worden businesses of earlier years have closed down, the town still offers all the goods and services essential for comfortable living. Worden will no doubt see a period of increased growth as more and more people leave Billings and even larger and more removed cities in search of the benefits that are derived from small-town living.

Huntley

Huntley, at the western end of the project, was the oldest settlement to develop into a town. Baker's Battle was the name first given the town, originally located on the north bank of the Yellowstone River.

The first church in Huntley was the Congregational Church, which also held services in the schoolhouse. Railroad cars served as the church and parsonage for the Presbyterian congregation.

The Lutheran Church was started in 1908, and in 1910 the Methodist Church was organized, with C. E. Fenton, father of the late Judge Fenton, as the first minister. In 1911 the parsonage was built.

The town of Huntley consisted of two lumber yards, two or three saloons, and three stores. Jap Day, the Huntley station attendant in 1905, accommodated workmen and supervisors who worked on the project irrigation system. He also helped to erect one of the three stores. The headquarters of the Reclamation Service was first located in Huntley, but it was later washed away by the river and was moved to Ballantine.

Huntley's newspaper was the *Huntley Journal.* A telegraph office was started in the early 1900's with J. W. Dayes as the telegraph operator. The post office, built in 1876, was named after S. O. Huntley, the stage contractor.

The river ferry started in 1877. It was an important stopping place for travelers on the Overland Road. The Northern Pacific Railroad, started in 1802, extended through the valley south of the Yellowstone River. As steamboat and overland traffic declined, Huntley's importance decreased.

WATER QUIZ

1. The average U.S. city dweller uses about ______ gallons of water a day.

2. Water purification techniques can be traced back as far as:

   a. 2000 B.C.
   b. 45 A.D.
   c. 500 B.C.
   d. none of the above

3. This scroll case, resembling an enormous snail, will be used at:

   a. the new Indian Falls Dam and adjoining bridge over the Snake River.
   b. the reservoir site, Calamity Jane in Montana
   c. the Grand Coulee Third Powerplant in Grand Coulee, Washington
   d. all of the above

4. Hydroelectric powerplants are common throughout the world. The plants depend upon the water flow from numerous rivers. Where in Europe is the hydroelectric powerplant which depends upon the tidal flow of water from the sea?

5. Steam power utilizes water's tendency to expand when heated. In what century was this energy source introduced in the United States?

Answers on page 32.

YESTERDAY IN OUR MAGAZINE

THE RECLAMATION ERA—1960

The San Angelo Story

By J. N. Gregory

Progress doesn't "just happen." People with vision make it happen. The people of San Angelo, Tex., a beautiful city of about 60,000, were not content to watch their community "wither on the vine" for the lack of water. What they did about it can be seen as a multiple-purpose dam at Twin Buttes site goes into construction. No longer will the city be limited because of a lack of water, but can look forward to growth, progress, and a bright future.

The progress that didn't "just happen" is the result of vision and leadership of progressive citizens led by Mr. M. D. Bryant. It was while Mr. Bryant was mayor of San Angelo that water shortages plagued the city, and in 1955 the Bureau of Reclamation was asked to study the problem and recommend a solution.

With information made available to him, he led the way in exploring every phase of water and land resource development. As a result of these studies and his continuing efforts, the San Angelo Water Supply Corp., was formed and has contracted with the Government for the construction of the Twin Buttes Dam, about 9 miles southwest of the city.

With this assured water supply, the city can plan many new and wonderful things to provide the greatest good to the greatest number of citizens of the San Angelo area.

The Twin Buttes Dam will be about 8 miles long and will trap and store the flows of the Middle and South Concho Rivers, and Spring Creek just upstream from Lake Nasworthy, one of the city's present sources of water. The contract for the dam and related works has been let to the H. B. Zachry Co., the low bidder, for $11,836,428, and construction has started. Through the intergrated operation of Twin Buttes Dam and San Angelo Reservoirs and Lake Nasworthy, an annual water supply of 29,000 acre-feet will be available for the city, and up to 25,000 acre-feet for irrigation. Twin Buttes Dam will also provide for flood control, fish and wildlife and recreation, and permit stabilization of the water elevation in Lake Nasworthy, greatly enhancing its value and beauty as a park and its shores as a residential area.

Initiation of construction on the Twin Buttes Dam was a signal for the start of an endless flow of benefits that will result from construction of the San Angelo project. This first noticeable effect came to town in the form of new employment opportunities, new families, and new payroll checks.

Benefits from this construction phase will last about 4 years, during which time it is estimated that about $11 million will be dispersed within the local area for wages paid to construction workers, the purchase of local building materials, and for fuel and oil for construction equipment.

The major portion of the expenditure will be for hired labor. Their wages will largely be spent within the local area for food, housing, clothing, recreation, and many other items needed to satisfy man's wants. In addition, local expenditures for right-of-way, relocation of highway and railroads, and other items will total about $6 million. A welcome boom for San Angelo merchants!

As activity within the local area increases due to increased sales, this activity, like a ripple caused by a rock thrown into a pond, will spread out to other regions of the State and into other States. Many manufacturing and industrial centers, wholesalers, and transportation concerns will feel the impact from supplying a stimulated market in San Angelo.

TODAY

RECLAMATION ERA—1974

More on San Angelo Project

The San Angelo project, in the immediate vicinity of the city of San Angelo in west-central Texas, includes Twin Buttes Dam and Reservoir, a headworks in the south abutment of the existing Nasworthy Dam, and an irrigation and distribution system to serve a project area of 10,000 acres.

Early History

The Concho River country, secured from the Indians about 1870, was first settled by the cattlemen, who were later followed by the farmers. Although much of the area is still devoted primarily to grazing, most of the land now cultivated was first broken and farmed between 1880 and 1910. The last of the State-owned lands in the area passed into private ownership soon after 1910.

Except for the city of San Angelo, the Concho River watershed is sparsely settled. The city owes its origin to the establishment in 1868 of a military post, Fort Concho, for protection against the Indians. Simultaneously with the construction of the fort, a settlement which formed the beginning of San Angelo developed across the river on the North Concho.

Twin Buttes Dam and Reservoir

Twin Buttes Dam is a 134-foot-high earthfill structure with a crest width of 30 feet and a crest length of over 8 miles. The embankment contains 21,442,000 cubic yards of material. An equalizing channel with a bottom width of 250 feet was excavated between the South Concho River and Spring Creek drainage areas.

The outlet works for the dam, located near the left abutment, include an approach channel from the Middle Concho River, a concrete intake structure, three-barreled concrete conduit with gate chamber and shaft, chute, and stilling basin. The spillway structure, also near the left abutment, is an uncontrolled ogee weir type 200 feet in width.

Twin Buttes Reservoir has a total capacity of 641,000 acre-feet with a surface area of 23,500 acres. The reservoir's active capacity is 632,000 acre-feet.

Benefits—Irrigation

Following the development period, bringing irrigation water to project lands not only increased yield per acre, but increased the variety of crops that can be grown. Principal crops are cotton, alfalfa, sorghum, oats, pasture, and grain.

Municipal and Industrial Water Supply

San Angelo, by far the most important population center in the area, has shown rapid growth since 1940 and constitutes the vast majority of population in the Concho River Basin. The San Angelo project assures an adequate water supply for the city until the year 2010, based on estimated population growth.

Flood Control

The North and South Concho Rivers, which join in the city of San Angelo, have produced numerous floods, resulting in extensive damage. The floods have occurred primarily as high peak, flash floods and have not been subject to forecast, resulting in catastrophic damage to urban and residential developments. Streamflow regulation provided by the project reduces agricultural losses in crops, livestock, and farm improvements, minimize land damage and protect recrea-

Continued on page 32

The Burn Center

By NAOMI BRYANT, Intern, Information Office, Mid-Pacific Region, Sacramento, Calif.

A Bureau of Reclamation safety manager recently completed a year working overtime to raise money for a facility he hopes will never have to be used.

Jack Castello, of the Central Valley Project Office in Fresno, Calif., with the help of his wife, Virginia, and Marlene and Jay Ingle raised $50,000 to furnish and equip a Total Care Burn Center at Valley Medical Center.

Jack's and Virginia's interest in burn centers began at 4:50 a.m. on July 11, 1971, when the Castellos received a telephone call from Valley Medical Center concerning their son, Paul. He had fallen asleep while smoking and his apartment had caught on fire.

He sustained second- and third-degree burns over 60 percent of his body. His injuries were so severe that the hospital felt there was only a 5-percent chance they could save him. For 11 days the staff of Valley Medical worked on Paul—11 days of drastic and intensive care. Yet at the end of those 11 days, it was necessary to fly Paul to Santa Clara Valley Medical Center in San Jose, 200 miles away, to receive the treatment available in a total care burn center.

Valley Medical does have burn rooms such as the one Paul was taken to upon his arrival. However, the best possible treatment for a burn patient is available only in facilities designed specifically for the treatment of burns, such as those at San Jose.

Virginia Castello, a registered nurse, is able to describe the plight of the burn victim from the unique point of view of an R.N., and a distraught mother:

"There exists no greater trauma to the human body than critical burns. Every hour of each day brings forth new problems, new complications and new obstacles to overcome. Each bodily organ is taxed to the fullest.

"Shock is a major concern. Fluid and protein loss is contant. Infections run rampant. Smoke and heat inhalation cause great concern. Weight loss is crucial. The daily removal of contaminated tissue is painful and itching becomes intolerable.

"Patients fight frustration and depression. They must endure beyond normal endurance, if they are to survive. Then they face many months of reconstructive and rehabilitative work. As one doctor so aptly stated: 'From an average patient, we expect average effort; but from a burn patient, we expect super-human effort.'

Jack Castello, second from right, and Jay Ingles wield sledge hammers to begin construction on the burn center. On hand to offer advice are Virginia Castello, Marlene Ingle, and Grover Johnson, Chairman of Valley Medical Center's Advisory Board. Photo courtesy Fresno Bee.

Jack Castello inspects the new hydrotherapy unit. Equipment such as this was purchased with moneys raised by volunteers.

Equipment designed specifically for burn patients, like this special bed, is important in the treatment of burn patients.

"With the advent of burn centers, mortality rates have been dramatically reduced, hospitalization time has been shortened by better than 50 percent, and these patients have been given the chance to return to a normal and productive way of life. This has been made possible through the dedicated efforts of the medical personnel, the miracles of modern-day research and the concentrated efforts of the family unit."

The importance and the efforts of the family unit cannot be overemphasized. During the 5½ months that Paul was hospitalized in that San Jose facility, the Castellos commuted 400 miles regularly in order to combine their efforts with those of the Santa Clara staff. When Paul was released into their care, there followed more months of treatment administered by Jack and Virginia Castello. At a point when they were able to relax their constant attention just a bit, they both vowed that some lasting good would come of their ordeal.

In furtherance of that vow, they publicly declared their determination to have a burn center installed in Valley Medical Center, so that the parents and relatives of future burn patients in the San Joaquin Valley would not have to depend upon a facility 200 miles away.

One immediate response to their pleas for help in the establishment of the center came from another man who had had close contact with burn victims—Jay Ingle, a local fireman and at that time the chairman of the San Joaquin Valley Fireman's Association.

"When I heard about their campaign to have a burn center built," said Jay, "I was surprised. I didn't know that there wasn't a burn center in Fresno. But as soon as I found out, I offered to do all I could to help."

Jay's offer of help was gladly accepted. He and his wife, Marlene, also a nurse, became cochairmen with the Castellos of the Valley Medical Center Burn Center Fund Drive.

Their first step was to go before the Valley Medical Center advisory committee, medical committee, and building committee with the proposal for the center. But they did not just ask those committees to approve their request, they promised to raise $50,000 for the furnishings and equipment to be put in the center.

With the backing of these committees, the proposal was then put before the Fresno County Board of Supervisors. The board of supervisors approved the transfer of $300,000 from the hospital's depreciation fund for the construction of the center. The money would be used to remodel the entire eastern wing of the north building of the Valley Medical Center.

Now the Castellos and the Ingles had to live up to their part of the bargain. They told their story to the Fresno community through radio and television interviews, numerous speaking engagements, and the placing of burn center equipment throughout the city. They encouraged many clubs and organizations to put on their own fund campaigns to help the burn center drive.

By July 11, 1973—2 years after Paul's entry into Valley Medical Center—the fund drive members had topped their goal of $50,000.

Soon, Valley Medical Center will be able to boast of its Total Care Burn Center. Thanks to the Castellos, the Ingles, and generous people of Fresno, it will be one of the best in the country.

However, it is easy to understand why Jack Castello hopes it will never have to be used. Those people who need the facility will have to experience what Paul Castello simply characterizes as "going through hell."

But Paul has recovered sufficiently to hold a job as night auditor at a motel because there was a burn center 200 miles away when he needed it. The Castellos and the Ingles have made certain that the same treatment that saved Paul will be available for others right there in the San Joaquin Valley.

news NOTES

RECLAMATION SELECTS NEW OFFICIALS

Jim Hart is Chief, Office of Public Affairs

Lawrence J. Hart, Jr., of the Sacramento, Calif., office has been appointed Chief, Office of Public Affairs.

Commissioner Stamm said, "Jim Hart is promoted to this important assignment of public affairs because of his excellent background in interpreting reclamation to the public. He has not only performed well in his more than 10 years with the Bureau in California, he has the advantage of an earlier successful career as a newsman, editor, and public relations man in private business."

Hart fills the position in Washington vacated in March 1973, by the retirement of Ottis Peterson, who retired after 27 years of service in the Bureau, including 24 in the Commissioner's office.

Before joining Reclamation, from 1961 to 1963, Hart was the managing editor of the *Arizona Journal.* Prior to that, from 1959 to 1961, he served as public relations director of the Ray Mines Division of the Kennecott Copper Corp. For 6 years from 1953, he was a newsman and city editor of the *Tucson Daily Citizen.*

Hart is married to the former Barbara Jones of Waddington, N.Y. The Harts have two grown daughters and a high school-age son.

Billy Spillers Named Chief of Personnel and Management Division

Commissioner Stamm named Billy H. Spillers to be Reclamation's new Chief of the Division of Personnel and Management in the Washington Office.

Spillers served in the U.S. Army from 1958 to 1960, and then began his Federal service as a personnel management specialist in 1963 in the Department of the Treasury. In 1965, he was promoted and transferred to the Bureau of Outdoor Recreation in Interior in a similar capacity.

In 1966, he went to the Department of Commerce as an employee relations specialist and in 1967 returned to Interior as a classification and wage specialist and personnel and management specialist in the Bureau of Sport Fisheries and Wildlife. He became personnel officer of the Bureau of Indian Affairs in 1970.

Spillers resides with his wife, Margaret, and their two children.

Dess Chappelear Becomes Chief of General Engineering

Dess L. Chappelear has been appointed Chief of the Division of General Engineering in the Washington office.

He worked in 1956 and 1957 as a hydraulic engineer in the Oklahoma City Development Office of the Bureau of Reclamation. He then moved to the Washita Basin project to work in the laboratory collecting data for the design and construction of Fort Cobb Dam, and later Foss Dam. In 1961, he transferred to the Canadian River project in Texas.

Chappelear transferred to the headquarters office of the Bureau in the Division of Water and Land in 1968, and until 1971 performed staff functions relating to multipurpose water control facilities and the operation and maintenance of the channel of the Lower Colorado River which has been of international concern between Mexico and the United States.

He resides with his wife, the former Retha I. Pritchard.

Hardi Jones Fills New EEO Position

Hardi L. Jones has been named to the newly established position of Equal Employment Opportunity Officer. He had been Equal Employment Opportunity

Officer for the U.S. Naval Oceanographic Office in Suitland, Md., since July 1971.

Commissioner Stamm said that Jones will have responsibility for improving and carrying out a Bureau-wide program to insure equal employment opportunity and equal rights in all Reclamation programs and activities.

"Prior to the establishment of a separate EEO officer position," said Commissioner Stamm, "Bureau equal opportunity matters had been the responsibility of the office of the Assistant Commissioner for Administration."

Hardi Jones began Government service in 1962 as an oceanographer with the National Oceanographic Data Center in Washington, D.C. In 1963, he transferred to a similar position with the Bureau of Commercial Fisheries in the Department of the Interior. In 1965, he was promoted and transferred to the U.S. Naval Oceanographic Office.

Jones is married to the former Yvonne Thompson of Warsaw, Va. They have two children and reside in Lanham, Md.

Study to Identify Ecological-Agricultural Effects of Cloud Seeding

A $74,758 contract has been awarded to the Natural Resource Ecology Laboratory at Colorado State University for a preliminary study of potential ecological and agricultural effects of cloud seeding over the High Plains.

The 6-month study is the first research project under the Bureau's High Plains Cooperative program, a new scientific attempt within the Bureau's atmospheric water resources management program to resolve the uncertainties remaining in the technology of summer cloud seeding over the High Plains area.

Although the main thrust of the High Plains program will be concerned with learning more about precipitation processes in the High Plains, a large part of the project will identify possible impacts in the grassland ecology and agricultural systems.

Dr. Freeman M. Smith will be the principal investigator in the study and will direct a team of university and State government scientists familiar with the High Plains.

Their objective is to provide an overall scientific appraisal and designs for further detailed research into the systems which may be affected by weather modification. This will include a critical review of past research, a designation of research priorities, identification of additional expertise in individuals and institutions and creation of a scientific and administrative framework for ensuing ecological and environmental research.

RECLAMATION LIBRARY

The American Artist and Water Reclamation

A catalog containing 65 reproductions—17 in full color—of paintings from the art collection of the Bureau may be purchased through the Government Printing Office.

The 74-page catalog is on sale by GPO at $1.75 per copy. Included is a foreword by Dr. Lloyd Goodrich of the Whitney Museum of American Art, New York, N.Y.; and an introduction by the late Douglas MacAgy of the Hirshhorn Museum, Washington, D.C.

All of the paintings reproduced in the catalog are now on a 4-year tour of art museums across the country under the auspices of the Traveling Exhibition Service, Smithsonian Institution.

Order forms are available from the Bureau of Reclamation, Room 7123, U.S. Department of the Interior, Washington, D.C. 20240.

Statistical Compilations

Did you know the Bureau of Reclamation has constructed 252 storage dams, 5,883 miles of canals, and 1,112,585 feet of tunnels? These are samplings of the many statistics included in the annually published *Statistical Compilations* of Bureau of Reclamation dams, storage reservoirs, pumping plants, and carriage facilities.

If such data would be useful to you, you may obtain copies of the fiscal year 1973 compilations from code 922, room 104, building 67, Engineering and Research Center, Denver Federal Center, Denver, Colo. 80225.

Letters to the Editor

Dear Editor:

Just a little word about your publication.

It is informative.

It is beautiful.

It is most satisfying.

Congratulations and thank you.

Pierre-O. Courtemanche,
Directeur,
Centre d'Etudes du Tourisme,
C. P. 1956,
Montreal 101, Quebec.

Dear Editor:

In this time of energy crises, I would like to know what the Bureau of Reclamation is doing to abate the problem? Also, what are its future plans?

I would appreciate any light you can shed on this subject facing all of us.

Sincerely,

Sharon Grillen Shool,
Portland, Oreg.

Dear Ms. Shool:

The article in this issue, "Reclamation's Geothermal Story," indicates that the Bureau is going to great lengths (or shall we say depths) to find sources of water which also may provide new energy sources. Much time, effort, and money are being expended in research.

The Bureau is also giving priority to construction of clean power—hydroelectric plants for multipurpose projects.

We will continue to carry stories in the *Era* about the role the Bureau of Reclamation is playing in the energy crisis in its water resource development programs.

—Editor.

Dear Editor:

Does the information in the "Yesterday" section of "Yesterday and Today in Our Magazine" really come from past issues of the *Reclamation Era?* Or is the material made up? There often is such a contrast in what happened then to what happens today.

Thank you,

John H. Young,
Salt Lake City, Utah.

Dear Mr. Young:

Every word of the "Yesterday" section comes from a past issue. The purpose of the section is to emphasize the contrast between yesterday and today.

—Editor.

Answers to Water Quiz:

1. 150. 2. a. 2000 B.C. A Sanskrit record advises treating water by "boiling it and dipping a piece of hot copper into it seven times." 3. c.—The Grand Coulee Third Powerplant. 4. France. It is near the mouth of the Rance estuary. Twice a day, a tidal flow nearly equivalent to that of the Mississippi River pours through the dam's 24 turbines and raises or lowers the water level 28 feet. 5. 18th Century.

Continued from page 25

tion facilities. Damage to urban and suburban property has been reduced.

Recreation

The arid, relatively barren nature of the area minimizes recreational opportunities. Consequently, surface water impoundments suitable for fish and wildlife and other recreational uses make an important contribution. Twin Buttes Reservoir also permits the maintaining of Nasworthy Reservoir at a relatively constant level, enhancing its recreational value.

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